

IN THE CLAIMS:

Please write the claims to read as follows:

Please cancel claims 16, 28, 32, 39, 46, and 53 without prejudice.

1 1. (Currently Amended): A policer based on Random Early Detection (RED), comprising:

3 a filter ~~that determinesto determine~~ a filtered virtual time debt, ~~the filtered virtual~~
4 ~~time debt determined based on an average difference between a time packets are expected~~
5 ~~to arrive and a time the packets actually arrive; and~~

6 a control law circuit ~~that receivesto receive~~ the filtered virtual time debt from the
7 filter and ~~determines-to determine~~ whether a packet should be dropped.

1 2. (Currently Amended): The RED policer of claim 1, wherein a virtual time debt ~~uses-is~~
2 ~~configured to use~~ a time T in which a packet is expected to arrive and is computed using
3 a predetermined output transmission rate.

1 3. (Original): The RED policer of claim 2, wherein predetermined output transmission
2 rate is given by a traffic contract.

1 4. (Previously Presented): The RED policer of claim 1, wherein the filter is based on an
2 exponential weighted moving average (EWMA) virtual time delay using the expression,

3
$$\text{EWMA}_k = (1-g)\text{EWMA}_{k-1} + g(\text{VTD})_k$$

4 where k indicates the presently received packet, and k-1 indicates the last packet
5 received, the virtual time debt (VTD) is computed by the expression: VTD = T(packet
6 expected to arrive) – T(packet actually arrives), and g is the gain of the filter.

1 5. (Currently Amended): The RED policer of claim 1, further ~~comprises comprising:~~ a
2 sampler ~~that samples to sample~~ a virtual time debt at a sampling interval, and ~~transmits to~~
3 transmit the sampled virtual time debt to the filter.

1 6. (Currently Amended): The RED policer of claim 1, further ~~comprises comprising:~~
2 a random generator ~~that generates to generate~~ a number based on the control law
3 circuit's determination as to whether a packet should be dropped; and

4 a counter ~~that is configured to be~~ set with the number generated by the random
5 generator, wherein the counter ~~counts is configured to count~~ packets passing through the
6 RED policer up to the set number, and wherein the RED policer ~~drops is configured to~~
7 drop a packet when the counter has counted out the set number.

1 7. (Currently Amended): The RED policer of claim 6, further ~~comprises comprising:~~
2 the control law circuit ~~that determines to determine~~ a probability of a packet being
3 dropped based on the filtered time debt exceeding a predetermined minimum threshold,
4 and ~~specifies to specify~~ a range of numbers based on the probability; and
5 the random generator ~~that to randomly generates generate~~ a number in the range
6 specified by the control law circuit.

1 8. (Currently Amended): A policer based on Random Early Detection (RED), compris-
2 ing:

3 means for determining a moving average of a virtual time debt, the virtual time
4 debt determined based on a difference between a time packets are expected to arrive and
5 a time the packets actually arrive; and

6 means for determining whether a packet should be dropped based on a value of
7 the moving average of the virtual time debt.

1 9. (Original): The RED policer of claim 8, further comprises means for sampling a vir-
2 tual time debt at a sampling interval, and transmitting the result to the moving average
3 determining means.

1 10. (Original): The RED policer of claim 8, further comprises:

2 means for generating a random number based on the result of the packet dropping
3 means; and

4 means for counting a number of packets passing through the RED policer up to
5 the random number generated by the random number generating means, wherein the
6 RED policer drops a packet when the counting means has counted out the generated ran-
7 dom number.

1 11. (Currently Amended): A network device comprising:

2 a plurality of Random Early Detection (RED) policers, wherein each RED policer
3 includescomprises,

4 a filter ~~that determinesto determine~~ a filtered virtual time debt, the filtered
5 virtual time debt determined based on an average difference between a time pack-
6 ets are expected to arrive and a time the packets actually arrive; and

7 a control law circuit ~~that receives~~ to receive the filtered virtual time debt
8 from the filter and ~~determines~~ to determine whether a packet should be dropped;
9 and
10 a packet classifier ~~that determines~~ to determine which packet should go to which
11 RED policer.

1 12. (Currently Amended): A method of policing packets in a network device, the
2 method comprising the steps of:

3 determining a filtered virtual time debt of a traffic, the filtered virtual time debt
4 determined based on an average difference between a time packets of the traffic are ex-
5 pected to arrive and a time the packets actually arrive;

6 comparing the filtered virtual time debt with a predetermined minimum threshold;
7 and if the filtered virtual time debt exceeds the minimum threshold, then

8 generating a random number that is used to determine which packet should be
9 dropped.

1 13. (Original): The method of claim 12, wherein generating a random number further
2 comprises the steps of:

3 generating the random number in a range based on a level by which the filtered
4 virtual time debt exceeds the minimum threshold;

5 setting a counter with the random number; and

6 dropping a packet when the counter has counted out the random number.

1 14. (Currently Amended): A computer readable medium having instructions contained
2 therein, which when executed by a computer performs a method comprising the steps of:

3 determining a filtered virtual time debt of a traffic, the filtered virtual time debt
4 determined based on an average difference between a time packets of the traffic are ex-
5 pected to arrive and a time the packets actually arrive;

6 comparing the filtered virtual time debt with a predetermined minimum threshold;
7 and if the filtered virtual time debt exceeds the minimum threshold, then

8 generating a random number that is used to determine which packet should be
9 dropped.

1 15. (Original): The medium of claim 14, wherein generating a random number further
2 comprises the steps of:

3 generating the random number in a range based on a level the filtered virtual time
4 debt exceeds the minimum threshold;

5 setting a counter with the random number; and

6 dropping a packet when the counter has counted out the random number.

1 16. (Canceled).

1 17. (Currently Amended): A method of policing packets in a network device, the
2 method comprising the steps of:

3 determining a filtered virtual time debt of packets flowing through the network
4 device, the filtered virtual time debt determined based on an average difference between a
5 time packets are expected to arrive and a time the packets actually arrive; and

6 determining whether a packet should be dropped based on the filtered virtual time
7 debt of the packets.

- 1 18. (Previously Presented): The method as in claim 17, further comprising: determining
- 2 that a packet should be dropped when a virtual time debt threshold has been reached.

- 1 19. (Previously Presented): The method as in claim 17, further comprising: determining
- 2 a moving average of the virtual time debt.

- 1 20. (Previously Presented): The method as in claim 17, further comprising: calculating
- 2 the virtual time debt as the difference between a time a packet is expected to arrive and a
- 3 time the packet actually arrives.

- 1 21. (Previously Presented): The method as in claim 20, further comprising: calculating
- 2 the time a packet is expected to arrive according to a traffic contract.

- 1 22. (Previously Presented): The method as in claim 17, further comprising: sampling the
- 2 virtual time debt at a sampling interval.

- 1 23. (Previously Presented): The method as in claim 17, further comprising:
 - 2 generating a random number;
 - 3 counting a number of packets passing through the network device up to the ran-
 - 4 dom number; and
 - 5 dropping a packet when the counted number reaches the random number.

- 1 24. (Currently Amended): A method of policing packets in a network device, the
- 2 method comprising the steps of:

3 determining a filtered virtual time debt of packets flowing through the network
4 device, the filtered virtual time debt computed as an average positive delay from an ex-
5 pected packet arrival time established by a traffic contract to an actual packet arrival
6 time;

7 determining that packets should be dropped when the filtered virtual time debt of
8 the packets exceeds a predetermined value; and if so

9 choosing a packet to be dropped, the chosen packet in response to a random num-
10 ber; and

11 dropping the chosen packet.

1 25. (Currently Amended): The method as in claim 24, further comprising:

2 generating the random number;

3 counting a number of packets passing through the network device up to the ran-
4 dom number; and

5 dropping a packet when the counted number reaches the random number.

1 26. (Currently Amended): A policer, comprising:

2 means for determining a filtered virtual time debt of packets flowing through the
3 network device, the virtual time debt computed as an average positive delay from an ex-
4 pected packet arrival time established by a traffic contract to an actual packet arrival
5 time;

6 means for determining that packets should be dropped when the virtual time debt
7 of the packets exceeds a predetermined value; and if so

8 means for choosing a packet to be dropped, the chosen packet in response to a
9 random number; and

10 means for dropping the chosen packet.

1 27. (Currently Amended): A computer readable media, the computer readable media
2 containing instructions for execution in a processor for the practice of the method com-
3 prising the steps of:

4 determining a filtered virtual time debt of packets flowing through the network
5 device, the filtered virtual time debt determined based on an average difference between a
6 time packets are expected to arrive and a time the packets actually arrive; and

7 determining whether a packet should be dropped based on the filtered virtual time
8 debt of the packets.

1 28. (Canceled).

1 29. (Currently Amended): A method of policing packets in a network device, the
2 method comprising the steps of:

3 determining a filtered virtual time debt of packets flowing through the network
4 device, the filtered virtual time debt computed as an average positive delay from an ex-
5 pected packet arrival time to an actual packet arrival time; and

6 determining whether a packet should be dropped based on the filtered virtual time
7 debt of the packets.

1 30. (Previously Presented): The method as in claim 29, in the event a packet should be
2 dropped, further comprising:

3 generating a random number;

4 counting a number of packets passing through the network device up to the ran-
5 dom number; and

6 dropping a packet when the counted number reaches the random number.

1 31. (Currently Amended): A method of policing packets in a network device, compris-
2 ing:

3 determining an actual arrival time of a packet;
4 determining a theoretical arrival time of the packet;
5 calculating a virtual time debt in response to the actual arrival time and the theo-
6 retical arrival time;
7 using a filter to determine a filtered virtual time debt of a traffic, the filtered vir-
8 tual time debt determined based on an average of a plurality of virtual time debts for the
9 traffic;
10 comparing the filtered virtual time debt with a predetermined value;
11 deciding if the filtered virtual time debt exceeds the predetermined value; and
12 generating, in response to the filtered virtual time debt exceeding the predeter-
13 mined value, a random number that is used to determine which packet should be dropped.

1 32. (Canceled).

1 33. (Currently Amended): The method of claim 31, further comprising:
2 — using a time T in which the packet is expected to arrive; and
3 computing a predetermined output transmission rate.

- 1 34. (Previously Presented): The method of claim 33, further comprising:
2 setting the predetermined output transmission rate by a traffic contract.
- 1 35. (Currently Amended): The method of claim 3231, further comprising:
2 sampling the virtual time debt at a sampling interval; and
3 transmitting the sampled virtual time debt to the filter.
- 1 36. (Currently Amended): The method of claim 31, further comprising:
2 using a counter that is set with the generated random number generated by the
3 random number generator;
4 counting packets passing through a RED policer up to the set number;
5 dropping the packet when the counter has counted out the set number.
- 1 37. (Currently Amended): The method of claim 31, further comprising:
2 determining a moving average ~~of~~for the filtered virtual time debt;~~and~~
3 ~~determining whether a packet should be dropped based on a value of the moving~~
4 ~~average of the virtual time debt.~~
- 1 38. (Currently Amended): A policer based on Random Early Detection (RED), comprising:
2 an operating system determines to determine an actual arrival time of a packet and
3 a theoretical arrival time of the packet;
4 a control law circuit ~~that calculates~~to i) calculate a virtual time debt in response to
5 the actual arrival time and the theoretical arrival time,

7 a filter to determine a filtered virtual time debt of a traffic, the filtered virtual time
8 debt determined based on an average of a plurality of virtual time debts for the traffic;

9 the control law circuit further to ii) compares compare the filtered virtual time
10 debt with a predetermined value, and iii) decides decide if the filtered virtual time debt
11 exceeds the predetermined value; and

12 a random number generator that generates to generate, in response to the filtered
13 virtual time debt exceeding the predetermined value, a random number that is used to de-
14 termine which packet should be dropped.

1 39. (Canceled).

1 40. (Currently Amended): The policer of claim 38, further comprising:

2 the filtered virtual time debt uses is configured to use time T in which the packet
3 is expected to arrive, and is computed using a predetermined output transmission rate.

1 41. (Previously Presented): The policer of claim 40, further comprising:

2 the predetermined output transmission rate is given by a traffic contract.

1 42. (Currently Amended): The policer of claim 3938, further comprising:

2 a sampler that samples to sample the virtual time debt at a sampling interval and
3 transmits to transmit the sampled virtual time debt to the filter.

1 43. (Currently Amended): The policer of claim 38, further comprising:

2 a counter that is configured to be set with the number generated by the random
3 number generator, and counts configured to count packets passing through the RED poli-
4 cer up to the set number; and

5 the RED policer drops configured to drop the packet when the counter has
6 counted out the set number.

1 44. (Currently Amended): The policer of claim 38, further comprising:

2 a filter that determines further to determine a moving average of for the filtered
3 virtual time debt; and
4 a control law circuit that determines whether a packet should be dropped based on
5 a value of the moving average of the virtual time debt.

1 45. (Currently Amended): An apparatus for policing packets in a network device, com-
2 prising:

3 means for determining an actual arrival time of a packet;
4 means for determining a theoretical arrival time of the packet;
5 means for calculating a virtual time debt in response to the actual arrival time and
6 the theoretical arrival time;
7 means for using a filter to determine a filtered virtual time debt of a traffic, the fil-
8 tered virtual time debt determined based on an average of a plurality of virtual time debts
9 for the traffic;

10 means for comparing the filtered virtual time debt with a predetermined value;
11 means for deciding if the filtered virtual time debt exceeds the predetermined
12 value; and

13 means for generating, in response to the filtered virtual time debt exceeding the
14 predetermined value, a random number that is used to determine which packet should be
15 dropped.

1 46. (Canceled).

1 47. (Currently Amended): The apparatus of claim 45, further comprising:
2 ~~means for using a time T in which the packet is expected to arrive; and~~
3 means for computing a predetermined output transmission rate.

1 48. (Previously Presented): The apparatus of claim 47, further comprising:
2 means for setting the predetermined output transmission rate by a traffic contract.

1 49. (Previously Presented): The apparatus of claim 46, further comprising:
2 means for sampling the virtual time debt at a sampling interval; and
3 means for transmitting the sampled virtual time debt to the filter.

1 50. (Previously Presented): The apparatus of claim 45, further comprising:
2 means for using a counter that is set with the number generated by the random
3 number generator;
4 means for counting packets passing through a RED policer up to the set number;
5 means for dropping the packet when the counter has counted out the set number.

1 51. (Currently Amended): The apparatus of claim 45, further comprising:
2 means for determining a moving average ~~of for the~~ filtered virtual time debt; and
3 means for determining whether a packet should be dropped based on a value of
4 the moving average of the virtual time debt.

1 52. (Currently Amended): A computer readable medium having instructions contained
2 therein, which when executed by a computer performs a method comprising the steps of:
1 determining an actual arrival time of a packet;
2 determining a theoretical arrival time of the packet;
3 calculating a virtual time debt in response to the actual arrival time and the theo-
4 retical arrival time;
5 using a filter to determine a filtered virtual time debt of a traffic, the filtered vir-
6 tual time debt determined based on an average of a plurality of virtual time debts for the
7 traffic;
8 comparing the filtered virtual time debt with a predetermined value;
9 deciding if the filtered virtual time debt exceeds the predetermined value; and
10 generating, in response to the filtered virtual time debt exceeding the predeter-
11 mined value, a random number that is used to determine which packet should be dropped.

1 53. (Canceled).

Please insert the following new claims 54 *et seq.*:

- 1 54. (New): The RED policer of claim 1, further comprising: the filter further configured
2 to calculate the average as an exponential weighted moving average (EWMA).

- 1 55. (New): The RED policer of claim 8, further comprising: means for calculating the
2 average as an exponential weighted moving average (EWMA).

- 1 56. (New): The network device of claim 11, further comprising: the filter further con-
2 figured to calculate the average as an exponential weighted moving average (EWMA).

- 1 57. (New): The method of claim 12, further comprising: calculating the average as an
2 exponential weighted moving average (EWMA).

- 1 58. (New): The medium of claim 14, further comprising the step of: calculating the av-
2 erage as an exponential weighted moving average (EWMA).

- 1 59. (New): The method of claim 17, further comprising: calculating the average as an
2 exponential weighted moving average (EWMA).

- 1 60. (New): The method of claim 24, further comprising: calculating the average as an
2 exponential weighted moving average (EWMA).

- 1 61. (New): The policer of claim 26, further comprising: means for calculating the average as an exponential weighted moving average (EWMA).
- 1 62. (New): The medium of claim 27, further comprising the step of: calculating the average as an exponential weighted moving average (EWMA).
- 1 63. (New): The method of claim 29, further comprising: calculating the average as an exponential weighted moving average (EWMA).
- 1 64. (New): The method of claim 31, further comprising: calculating the average as an exponential weighted moving average (EWMA).
- 1 65. (New): The policer of claim 38, further comprising: the filter further configured to calculate the average as an exponential weighted moving average (EWMA).
- 1 66. (New): The apparatus of claim 45, further comprising: means for calculating the average as an exponential weighted moving average (EWMA).
- 1 67. (New): The medium of claim 52, further comprising the step of: calculating the average as an exponential weighted moving average (EWMA).